

Claims

5 1. Method to distinguish, whether an event sequence is a memory driven event sequence or is not a memory driven event sequence on a time scale T_1 to T_2 , where $T_1 < T_2$ are arbitrary times, characterized in that

10 a) the first order autocorrelation function $G(\tau)$ of the event sequence is calculated,

b) the second order autocorrelation function $G(\tau_1, \tau_2)$ of the event sequence is calculated,

15 c) it is decided that the event sequence is a memory driven event sequence on the time scale T_1 to T_2 ,

20 if the second order autocorrelation function of the event sequence can be expressed within experimental error as the product of first order autocorrelation functions, i.e. $G(\tau_1, \tau_2) = G(\tau_1) * G(\tau_2)$ for $T_1 < \tau_1, \tau_2 < T_2$, and

25 d) it is decided that the event sequence is not a memory driven event sequence on the time scale T_1 to T_2 ,

if the second order autocorrelation function of the event sequence cannot be expressed within experimental error as the product of first order autocorrelation functions, i.e. $G(\tau_1, \tau_2) \neq G(\tau_1) * G(\tau_2)$ for $T_1 < \tau_1, \tau_2 < T_2$.

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2. Method according to claim 1, characterized in that

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- a) the first order autocorrelation function $G(\tau)$ of the event sequence is calculated as:

$$G(\tau) \equiv \frac{E(X_0 X_\tau)}{E(X_0)E(X_\tau)}$$

where X is the random variable that describes the event and $E(.)$ denotes the expectation value,

- b) the second order autocorrelation function $G(\tau_1, \tau_2)$ of the event sequence is calculated as:

$$G(\tau_1, \tau_2) \equiv \frac{E(X_0 X_{\tau_1} X_{\tau_1+\tau_2})}{E(X_0)E(X_{\tau_1})E(X_{\tau_1+\tau_2})}$$

where X is the random variable that describes the event and $E(.)$ denotes the expectation value,

3. Method according to claim 1, characterised in that the degree of memory of the system is quantified by the non-Markovian function NMF calculated according to:

$$\text{NMF}(\tau_1, \tau_2) = p_f \left(\frac{G(\tau_1, \tau_2)}{G(\tau_2)} - G(\tau_1) \right),$$

where p_f is the probability of the event X at a particular time.

4. Method according to claim 1, characterized in that the event sequence is a sequence of fluorescence events observed in a confocal microscope.

5. Method according to claim 4 to discriminate an event sequence from a single molecule against an event sequence from background processes or noise,

characterized in that

- a) it is decided that the event sequence is due to a single molecule, if it is a memory driven event sequence,
- b) it is decided that the event sequence is due to background processes or noise, if it is a non-memory driven event sequence.

6. Method according to claim 5 for single molecule sequencing,

characterized in that

- a) it is decided that the fluorescence events observed are due to nuclease-liberated nucleotides if the sequence of fluorescence events is a memory driven sequence of events and
- b) it is decided that the fluorescence events observed are due to contaminating nucleotides or other background signals, if the sequence of fluorescence events is not a memory driven sequence of events.

7. Method according to claim 6, characterized in that the fluorescence events are observed in a confocal microscope.

8. Method according to claim 6 or 7 for analyzing of catalytic complexes, characterized in that

- a) it is decided that the fluorescence events observed are due to characteristics of the catalytic complex if the sequence of fluorescence events is a memory driven sequence of events and
- b) it is decided that the fluorescence events observed are due to contaminating nucleotides or other background signals, if the

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sequence of fluorescence events is not a memory driven
sequence of events.

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9. Method according to claim 8, characterized in that the catalytic complex comprises a catalyst, a substrate being converted to a product and optionally a cosubstrate.

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10. Method according to claim 8 or 9, characterized in that the catalyst is selected from biomolecules, e.g. enzymes, inorganic molecules and organic molecules.

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11. Method according to one of the claims 5 - 10 wherein an oscillating process is analyzed.

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